Ex. the non-degenerating form follows "up to" transformation, reflection, and rotation.

Name	Equation
Ellipsoid	$\frac{x^2}{a}+\frac{y^2}{b}+\frac{z^2}{c}=1$
Cone	$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=0$
Elliptic Paraboloid	$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z}{c}=0$

Ex. $x^2-y^2-z^2-4x-2z+3=0$

① Rewrite $0=x^2-y^2-z^2-4x-2z+3$

$0=(x^2-4x+4)+(-y^2)+(-z^2-2z-1)$

$0=(x-2)^2-y^2-(z+1)^2$

Let's understand the cross-section of this picture with respect to (wrt) the coordinate planes (shifted)

when $z=k$ (constant)

i.e. $(x-2)^2-y^2=(k+1)^2$ | hyperbola

when $y=k$

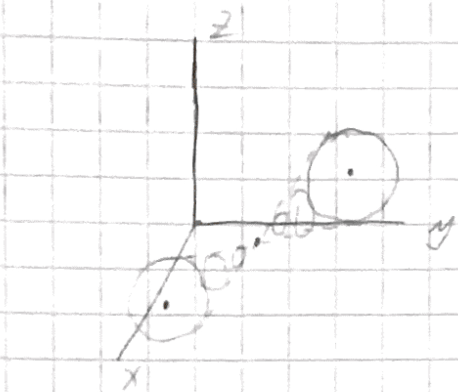
i.e. $(x-2)^2-(z+1)^2=k^2$ | hyperbola

when $x=k$

$y^2+(z+1)^2=(k-2)^2$ | ellipse

Conic Sections	
$\frac{x^2}{a^2}+\frac{y^2}{b^2}=\cancel{z}\ 1$	ellipse
$\frac{x^2}{a^2}-\frac{y}{b}=c$	parabola
$\frac{x^2}{a^2}-\frac{y^2}{b^2}=c$	hyperbola

Picture:

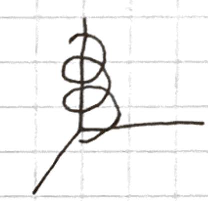


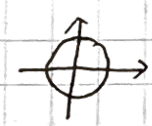
Section 13.1 Space Curves

A space curve is a function

$\vec{r} : I \to \mathbb{R}^2$.

Ex. The Helix is the space curve

$\vec{r}(t) = \langle \cos(t), \sin(t), t \rangle \Rightarrow$ 

shadow in x-y plane 

Defination: Limit of a space curve

$\vec{r}(t) = \langle x(t), y(t), z(t) \rangle$

at $t=a$ is the componentwise limit if they all exist.

$$\lim_{t\to a} \vec{r}(t) = \lim_{t\to a} \langle x(t), y(t), z(t) \rangle = \langle \lim_{t\to a} x(t), \lim_{t\to a} y(t), \lim_{t\to a} z(t) \rangle$$

Ex. Compute the limit of $\vec{r}(t) = \langle \cancel{4+\sin(20t), 4+\sin}\ 4+\sin(20t)\cos(t), [4+\sin(20t)]\cos(t), \cos(20t) \rangle$ at $t = \frac{5\pi}{8}$.

$F : I \to \mathbb{R}^n$

The limit of $F(t)$ is completely computed wise